PROCEEDINGS

OF THE

Montreal College of Pharmacy.

PAPER

ON THE

EUCALYPTS OF AUSTRALIA.

BY

CHRISTIAN HOFFMANN,

OF THE GEOLOGICAL SURVEY OF CANADA,

LATE PHYTOLOGIC CHEMIST TO THE STATE GARDENS, MELBOURNE,
VICTORIA, AUSTRALIA.

Read on 6th February, 1873.

MONTREAL:
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INTRODUCTORY REMARKS.

It was at first contemplated merely to treat of the essential oils which are obtained from the foliage of this genus: but, inasmuch as the timber, barks, gum-resins, etc., derived from these trees, likewise possess properties which give them an interest, if not indeed a value, I considered it expedient to devote a few words to each.

To have entered into botanical descriptions would have been foreign to the object of the "Memoir": I have, however, given the scientific name, and geographical range of the several species brought under notice in the course of the text.

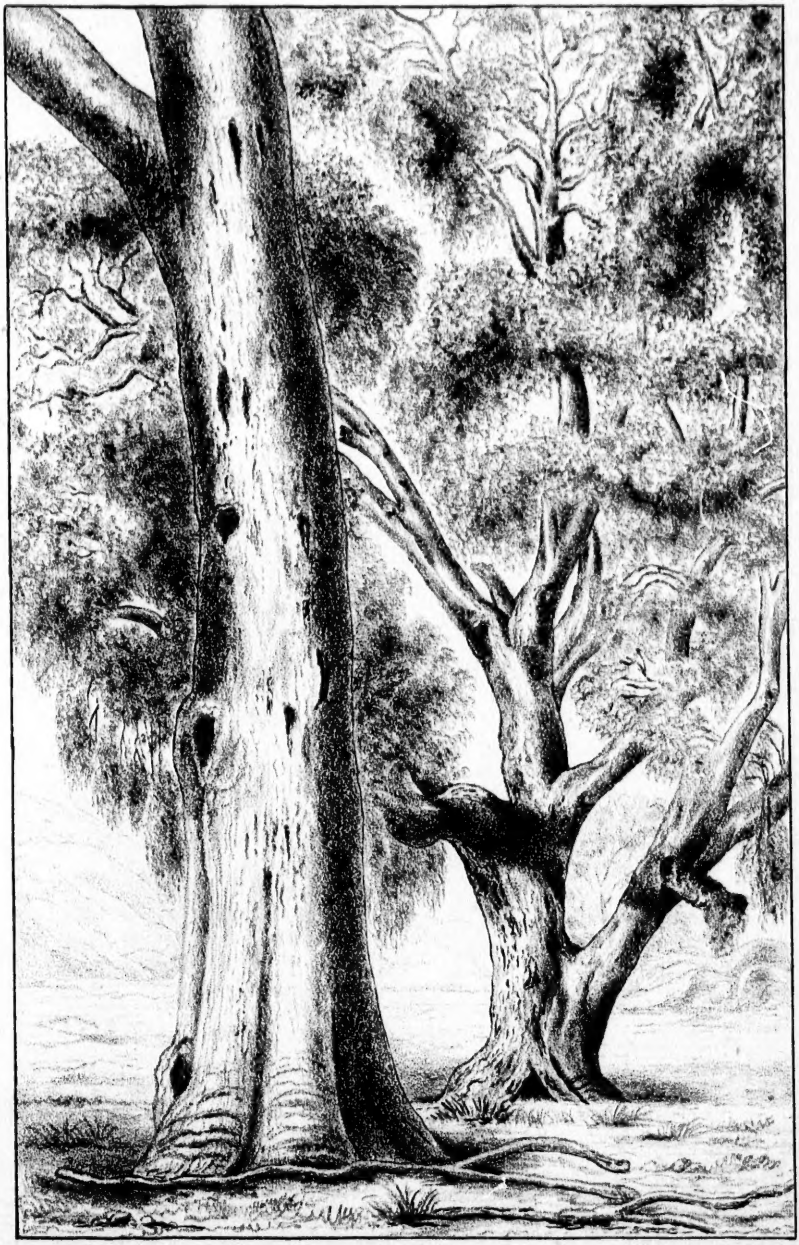
The Essential Oils have been dwelt upon at some length. With regard to the medicinal properties of the leaves and essential oil of *E. globulus*, I have, to the best of my knowledge, given the results of the most recent investigations on the subject. Tables have been introduced, shewing the results of experiments instituted in reference to the yield of potash from trees of this genus, and to the products of the dry distillation of their timber. Allusion has been made to the barks as tanning and paper material, results of experiments in both directions being given. Finally, a few remarks have been made upon the gum-resins, and a line or two devoted to the description of two varieties of a substance called manna.

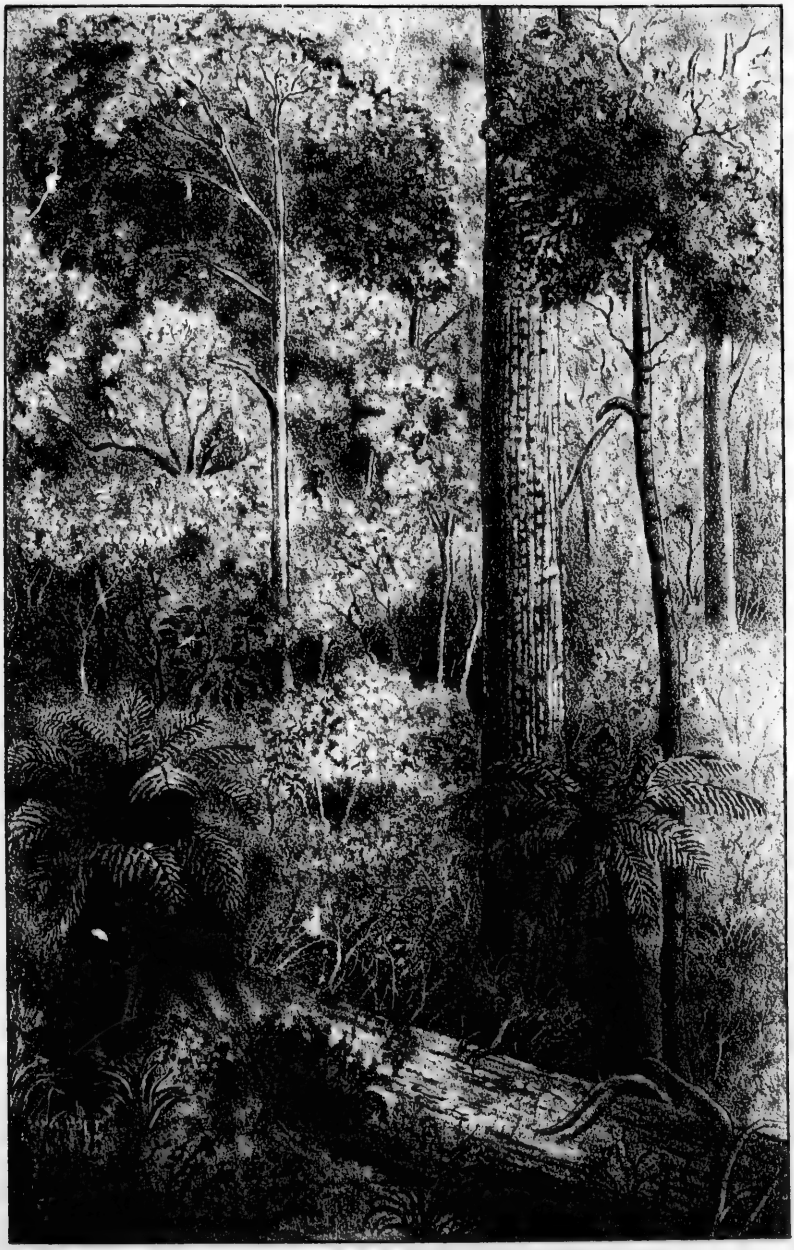
In the form of an Appendix to this Paper will be found an account of a very interesting series of essential oils, obtained from certain species of the genus Melaleuca, (order Myrtaceæ) and other indigenous Victorian plants; with one exception, all possessing therapeutic properties, and resembling more or less some of the medicinal oils of commerce.

What information I possess on the subject herein treated of, was gained during the five years in which I was connected with the Department of the learned Government Botanist and Director of the State Gardens, Victoria, Australia: I allude to Baron Von Mueller, a name widely known in the scientific world, and one intimately associated with the Flora of Australia.

I should like it to be understood that the various investigations, alluded to in the course of these pages, as having been carried out by me, in my capacity of Chemist to the Gardens, were in all instances suggested by Baron Von Mueller, who at the same time selected and furnished me with the required material. For many of the descriptions herein given, I am also indebted to the same gentleman.

I cannot conclude without expressing my indebtedness to Alfred R. C. Selwyn, F.G.S., Esq., Director of the Geological Survey of Canada, for his kindness in having placed at my disposal a series of Australian views, thereby enabling me to insert some illustrations: the same have been very skillfully drawn and lithographed by Mr. A. H. Foord, Artist to the Survey.





PROCEEDINGS

OF THE

Montreal College of Pharmacy.

The regular Monthly Meeting of the College was held on the 6th inst., in the Lecture Hall of the Pharmaceutical Society of the Province of Quebec. Mr. John Gardner, President, occupied the chair.

After the reading and approval of minutes, and the usual routine of business, the President called upon Mr. C. Hoffmann to read a paper on the

EUCALYPTS OF AUSTRALIA.

The Eucalypts are a genus of trees of the natural order Myrtaceæ; they are evergreens, with entire and leathery leaves, which instead of having one surface towards the sky and the other towards the earth, are often placed with their edges in this direction, so that each side is exposed to the light.

This genus, of which at present some one hundred and forty species are known, forms one of the most characteristic features of Australian vegetation, in which it also occupies a very large place, comprising a great number of forest trees, many of them of magnificent proportions. Under favorable conditions of growth, viz., in the sheltered depressions within the Ranges, many varieties attain a colossal size; in more open places, however, they usually occur as middle sized trees. Amongst the species which embrace trees of gigantic growth may be enumerated: *Eucalyptus amygdalina*, Labillardière — one of the Peppermint-trees; *Eucalyptus goniocalyx*, Ferd. Mueller—one of the White Gumtrees; *Eucalyptus Stuartiana*, Ferd. Mueller —also one of the White Gumtrees; and *Eucalyptus obliqua*, L'Heritier, the Stringybark-tree.

A tree of *Eucalyptus amygdalina* in the recesses of Dandenong, was measured by Mr. D. Boyle, and found to have attained a height of 420 feet. Mr. G. W. Robinson supposes this Eucalypt towards the sources of the Yarra to attain a height of 500 feet. He found the circumference of a tree growing in the back ranges of Berwick to be 81 feet, at the distance of 4 feet from the ground. A Eucalyptus on the Black Spur was measured by Mr. G. Klein, and its height found to be 480 feet, consequently exceeding by 40 feet twice the height of the towers of Notre Dame Cathedral in this city, and overtopping the tallest of the celebrated *Sequoia Wellingtonia's*, or Big Trees of California, by 155 feet; as, according to J. D. Whitney, the State Geologist, the Sequoia known by the name of "Keystone State," in the Calaveras grove, stands at the head of the Big Trees, with an elevation of 325 feet, and this, he adds, is the tallest tree yet measured on this continent, so far as our information goes.

If the size of these Eucalypts is astonishing, not less remarkable is the quantity of timber supported by the soil in the places where they grow. In the State forest at Dandenong (Victoria), it was found by actual measurement that an acre of ground contained twenty large trees of an apparent average height of about 350 feet, and thirty-eight saplings of an apparent average height of fifty feet; the land being occupied besides by a dense undergrowth. Again, in one of the densest parts of the Mount Macedon State forest, an acre of messmate (*Eucalyptus fissilis*, Ferd. Mueller) forest was found to contain forty-two large standing trees and twelve saplings. Many of the largest of these trees were from six to seven feet in diameter, four feet from the ground, and from 200 to 220 feet high. These measurements were taken by Messrs. Couchman and R. Brough Smyth; the latter gentleman states that in the Mount Juliet Ranges, he found trees of far greater height and standing much closer together than in the Macedon Ranges. The Eucalypts are of very rapid growth, and it is more than probable that the extraordinary dimensions which some of these trees have attained is not so much the result of a very great age, but is rather due to extreme rapidity of growth. This marvellous quickness of growth, combined with a perfect fitness to resist drought, has rendered many of these trees famed abroad. Baron Von Mueller says: "In Australian vegetation we probably possess the means of obliterating the rainless zones of the globe, to spread at last woods over

our deserts, and thereby to mitigate the distressing drought, and to annihilate perhaps even that occasionally excessive dry heat evolved by the sun's rays from the naked ground throughout extensive regions of the interior, and wafted with the current of air to the east and south, miseries from which the prevalence of sea breezes renders the more littoral tracts of West and North Australia almost free." Again: "Even the rugged escarpments of the desolate ranges of Tunis, Algiers, and Morocco, might become wooded: even the Sahara itself, if it could not be conquered and rendered habitable, might have the extent of its oasis vastly augmented; fertility might be secured again to the Holy Land, and rain to the Asiatic plateau or the desert of Atacama, or timber and fuel be furnished to Natal and La Plata." A great many of these trees are valuable for their timber, their barks, their secretion of gum-resins, and for the essential oils obtained from their leaves, each of which has been treated of, more or less, in detail, under their respective headings, in the following pages.

Before quitting this part of the subject, it may be desirable to speak in detail of the *Eucalyptus globulus*, for the reason that this is the species which has been introduced into Southern Europe, Algeria, etc., and is therefore better known outside of Australia than any of the other varieties; and has consequently been made the subject of closer investigation. It may here be remarked that the introduction of this and other species of the genus into other countries is mainly due to the exertions of Baron Von Mueller.

The *Eucalyptus globulus*, Labillardière—the Blue Gumtree (so called from the peculiar hue of its foliage) of Victoria and Tasmania (but not of New South Wales and West Australia), is restricted to the two former colonies. The *Eucalyptus megacarpa*, Ferd. Mueller, which constitutes the blue gumtree of Western Australia, rivals that of Victoria and Tasmania in size, but is otherwise very distinct. The blue gumtree in Victoria often reaches to nearly 300 feet, and to 120 feet without a lateral branch, presenting a most noble object in the landscape. A plank of this wood was imported into England for the Great Exhibition; it measured 100 feet in length, two feet six inches broad, and three inches in thickness, and sold for more than £100. Its leaves are from four to seven inches long, and one inch in breadth, shining on both surfaces. Like its congeners,

this tree is of very rapid growth; the leaves and roots have a very great absorbent power for moisture, thus having a tendency to dry the earth under it, which makes the tree peculiarly suitable for marshy and in consequence unhealthy districts.

M. Papillon, who has written a memoir upon the *Eucalyptus globulus*, considered from an hygenic, economic, medicinal, and pharmaceutical point of view, gives the following particulars as to pharmaceutical preparations obtained from it. Besides the essence eucalyptol (vide 5, *Eucalyptus globulus*, under heading Essential Oils), to which the Eucalyptus largely owes its medicinal properties, it contains a solid, resinous bitter principle, little known as yet, from which the leaves derive their febrifuge qualities.

The following preparations, etc., are at present manufactured from Eucalyptus:

1. The essence, which is administered in doses of a few grms,* in the form of globules.

2. Leaf powder, which contains all the active principles of the plant (essential oil, tannin, bitter principle), and which is prescribed in doses of 4, 8, 12, and even 16 grms daily.

3. The infusion and decoction of the leaves. With half a leaf (about 1 grm.) it is possible to aromatise three or four cups, affording a good substitute for tea, employed as a stimulating drink. For topic applications, 8 grms. in decoction, in a litre† of water, forms a liquor well charged with the principles indicated.

4. Water distilled from the leaves, which may be advantageously used with stimulating drinks.

5. Aqueous extract, alcoholic extract, employed as febrifuges.

6. Tincture, or alcoholate.

7. A liquor, which is similar to the liquor of mastic, and a wine which is a tonic and febrifuge.

8. Cigars and cigarettes.

Dr. Gimbert has studied, on himself, the effects of essence (essential oil) of Eucalyptus when taken into the system. He took various doses of from 10 to 20 drops. He found it had a soothing effect. It diminishes the vascular tension, and the sense of comfort arising from it induces to sleep. A very strong

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* 1 Gramme = 15.432 Troy grains.

† 1 Litre = 1.76 Imperial pints.

dose produces a temporary excitement, headache, and slight fatigue.

Dr. Rabuteau states that the leaves contain no alkaloid. Count Maillard de Marafy from experiments instituted by him, announces that the leaves can be used as a substitute for sumach. The tincture is stated to be an excellent remedy against ague and intermittent fever, especially that kind which is often epidemic in marshy districts, and Spanish physicians have pronounced it efficacious in such cases. Other preparations alluded to in above list possess powerful tonic and diffusible stimulant properties, performing remarkable cures in cases of chronic catarrh and dyspepsia, and some form an excellent antiseptic application to wounds. From this it will be seen that this Eucalypt may become of very great importance in a medicinal point of view, if in no other, and considering their analogy in other respects it would not be surprising if many other of the species were found to possess equally important properties.

I.—Timber of the Eucalypts.

The timber of the Eucalypts when green, is generally soft, but when cut into beams, planks, etc., and exposed for a short time to atmospheric influence becomes very hard and in consequence difficult to work; this hardening is attributed to the increased density of the woody structure and to the solidification of the gum resin, which is copiously distributed throughout its substance.

This genus furnishes the most important of the native woods employed for economical purposes; and, according to their individual properties, often strongly marked, are well adapted for the various purposes of the shipbuilder, millwright, wheelwright, coachmaker and carpenter; and many, from the great beauty of their duramen, and the very high and beautiful polish which they are capable of receiving, are justly favorites with the cabinet maker.

The timber of *Eucalyptus marginata*, Smith—the Swan River or West Australian mahogany, or mahogany eucalypt (restricted to Western Australia), is worthy of special notice, from the wonderful property it possesses of being absolutely impervious to the inroads of the Limnoria, Teredo and Chelura: a property which eminently adapts it for the construction of wharves, jetties,

and all work of naval architecture exposed to sea-water: it moreover resists the attacks of termites, and on this account is extensively employed in India for railway sleepers.

The timber of *Eucalyptus rostrata*, Schlechtendal—the Red Gumtree (but not the red gumtree of Western Australia, which is widely different), possesses the properties ascribed to *Eucalyptus marginata*, almost in an equal degree.

As many may feel interested in knowing what the yield of Potassa is from these trees, I have selected from my determinations of Potassa in a variety of indigenous trees, such as had reference to the Eucalypts, and embodied the results in the following Tables I, II, and III.

I also submitted a number of the native woods to destructive distillation, determining the percentage yield of charcoal, tar, and crude wood-vinegar, and again, in the latter the proportion of wood-spirit, acetic acid and other constituents: as in the former instance, such as have reference to the Eucalypts have been selected, and the results given in adjoining Tables IV and V.

The woods employed were thoroughly air-dried, the amount torrefied in each case—25 pounds.

TABLES

Shewing the amount of Potash in the Leaves, Branchlets and Branchwood, and Trunkwood, of the following Eucalypts, viz: *E. globulus, E. rostrata, E. viminalis, E. melliodora* and *E. obliqua.*

Table I. Leaves.

SPECIES OF TREE.		Moisture in a hundred parts.		Ash in a hundred parts of		Ratio of the soluble constituents of the ash to the insoluble, centesimally expressed.		Potash in a hundred parts of				Color of the Ash.
Systematic Name.	Vernacular Name.	Water.	Dry substance.	Fresh Leaves	Dry Leaves	In Water		Fresh Leaves	Dry Leaves	Ash	The soluble portion of the Ash	
						Soluble	Insoluble					
Eucalyptus globulus	Blue Gumtree - -	49.69	50.31	2.94	5.84	17.75	82.25	0.31	0 62	10.60	59.72	Light grey.
" rostrata -	Red Gumtree - -	48.98	51.02	3.08	6.04	22.66	77.34	0.42	0.82	13 61	60.06	Light grey.
" viminalis	Manna Eucalypt -	58.19	41.81	1.75	4.18	47.42	52.58	0.48	1.15	27.65	58 31	Light reddish grey.
" melliodora	Small-leaved box tree	50.75	49.25	2.28	4.63	39 79	60.21	0.40	0.81	17 48	43 88	White, yellowish tinge
" obliqua -	Stringybark-tree -	57.62	42 38	1.56	3.68	33 09	66.91	0.21	0.50	13 67	41.31	White, yellowish tinge

Note.—The percentage of water is slightly augmented by loss by essential oil. The greatest error resulting from this cause would occur in the percentage of water in the leaves of Eucalyptus globulus (which afford a larger percentage of essential oil than any of the other leaves here employed) and could here amount to 0.72 per cent.

Table II. Branchlets and Branchwood, with Bark.

SPECIES OF TREE.		Moisture in a hundred parts		Ash in a hundred parts of		Ratio of the soluble constituents of the ash to the insoluble, centesimally expressed.		Potash in a hundred parts of				Color of the Ash.
Systematic Name.	Vernacular Name.	Water.	Dry substance.	Fresh branchlets and branchwood, with bark.	Dry branchlets and branchwood, with bark.	In Water		Fresh branchlets and branchwood, with bark.	Dry branchlets and branchwood, with bark.	Ash	The soluble portion of the Ash	
						Soluble	Insoluble.					
Eucalyptus globulus	Blue Gumtree - -	46.56	53.44	2.00	3 74	12.86	87.14	0.14	0.26	7.08	55.05	Light brownish grey.
" rostrata -	Red Gumtree - -	44.56	55.44	1.87	3.37	11.87	88.13	0.11	0.19	5.74	48.36	Light brownish grey.
" viminalis	Manna Eucalypt -	47.69	52.31	0.84	1.60	20.20	79 80	0.09	0.18	11.13	55.10	Light brownish grey.
" melliodora	Small-leaved box tree	39.87	60.13	2.19	3.64	11.37	88.63	0.08	0.13	3.59	31.57	White, yellowish tinge
" obliqua -	Stringybark-tree -	....	....	....	....	....	....	....	....	....	....	

Table III. Trunkwood, without Bark.

SPECIES OF TREE.		Moisture in a hundred parts		Ash in a hundred parts of		Ratio of the soluble constituents of the ash to the insoluble, centesimally expressed.		Potash in a hundred parts of				Color of the Ash.
Systematic Name.	Vernacular Name.	Water.	Dry substance.	Fresh Trunkwood.	Dry Trunkwood.	In Water		Fresh Trunkwood.	Dry Trunkwood.	Ash.	The soluble portion of the Ash.	
						Soluble	Insoluble					
Eucalyptus globulus	Blue Gumtree - -	52.19	47.81	0.37	0.77	26.16	73.84	0.06	0.12	15.79	60.36	White, yellowish tinge
" rostrata -	Red Gumtree - -	51.25	48.75	0.18	0.37	48.76	51.24	0.05	0.10	27.88	57.18	Light brown.
" viminalis	Manna Eucalypt -	44.56	55.44	0.44	0.79	17.27	82.73	0.05	0.08	10.60	61.38	Light yellowish.
" melliodora	Small-leaved box tree	32.25	67.75	0.75	1.11	6.50	93.50	0.02	0.04	3.36	51.69	White.
" obliqua -	Stringybark tree -	....	....	....	0.14	31.92	68.08	....	0.03	19.01	59.55	Light reddish.

TABLE IV,

Showing the yield of Charcoal, Crude Wood Vinegar, Tar, and Uncondensible Gases, for 100 parts of the different woods.

SPECIES OF WOOD. { Systematic Name / Vernacular Name	Eucalyptus Leucoxylon. *F. Muell.* Ironbark tree.	Eucalyptus rostrata. *Schl.* Red Gumtree.	Eucalyptus obliqua. *L'Herit.* Stringybark tree.	Eucalyptus globulus. *Lab.* Blue Gumtree.
Charcoal	28.500	29.250	29.125	28.750
Crude Wood Vinegar	44.875	41.125	43.750	45.500
Tar	6.312	6.687	6.062	6.250
Uncondensible gases	20.313	22.938	21.063	19.500
	100.000	100.000	100.000	100.000

TABLE V,

Showing the amount of pure hydrated Acetic Acid, the amount in gallons of proof Vinegar of the revenue (sp. gr. 1.0085), represented by the hydrated Acetic Acid, real Wood Spirit, and Wood Vinegar Tar residue contained in the Crude Wood Vinegar, obtained from 100 pounds of the woods. The measure of the Crude Wood Vinegar and the amount of dry Acetate of Lime it furnished. The amount of pure hydrated Acetic Acid and real Wood Spirit in the Crude Wood Vinegar, p. c.

SPECIES OF WOOD.		Weight of Crude Wood Vinegar.	Measure of Crude Wood Vinegar in ounces.	Weight of dry Acetate of Lime produced.	Amount of pure hydrated Acetic Acid.	Amount of proof Vinegar in gallons.	Amount of pure hydrated Acetic Acid in the Crude Wood Vinegar, per ct.	Amount of real Wood Spirit.	Amount of real Wood Spirit in the Crude Wood Vinegar, p.c.	Weight of Wood Vinegar Tar residue.
Systematic Name.	Vernacular Name.									
Eucalyptus Leucoxylon	Ironbark tree	44.875	672	3.69	1.442	2.32	3.213	1.596	3.556	3.312
" rostrata	Red Gumtree	41.125	660	4.06	1.126	1.81	2.737	2.017	4.904	3.312
" obliqua	Stringybark tree	43.750	656	3.88	1.155	1.85	2.640	2.069	4.729	4.937
" globulus	Blue Gumtree	45.500	676	3.94	1.171	1.88	2.573	1.810	3.978	5.312

II. The Bark of the Eucalypts.

The bark of some of these trees is remarkable for its hardness, notably so that of the so-called iron-bark tree (*Eucalyptus Leucoxylon*, Fred. Mueller), which is particularly thick and rugged, and studded with deposits of a dark thick gum-resin: others are thick and bulky, of a lax and what might be termed fibrous texture; this especially holds good with regard to that of the so-called stringybark tree (*Eucalyptus obliqua*, L'Heritier), which is removed in large sheets and employed for roofing purposes in the interior, affording a cool and effectual shelter from the sun and rain. The aborigines are very dexterous in the art of separating it from the tree and flattening it for the purpose alluded to. Some species throw off their outer bark in longitudinal strips, which hanging down from the stems and branches, present a very singular appearance. Amongst a variety of material upon which I experimented with the view of ascertaining their applicability to paper making, were the barks of a number of species of Eucalypts. From my samples of paper it was inferred that the barks of *Eucalyptus obliqua*, L'Her., *Eucalyptus rostrata*, Schl., *Eucalyptus amygdalina*, Lab., *Eucalyptus globulus*, Lab., *Eucalyptus goniocalyx*, F. M., *Eucalyptus corymbosa*, Sm., *Eucalyptus Leucoxylon*, F. M., *Eucalyptus longifolia*, Link., and *Eucalyptus Stuartiana*, F. M., were all well adapted for the manufacture of packing paper, mill and paste boards; that of the *E. globulus* possibly also for printing paper; and that of *E. obliqua* also for printing and even for writing paper. From this it may be inferred that they are not unlikely to meet with applications in this branch of industry.

The barks of many of the species are remarkable for their astringent qualities, and upon examination were found to contain appreciable quantities of tannin. From my determinations the following have been selected, which may serve to show the probable value of the barks as tanning materials.

TABLE VI.

Showing the percentage of Tannic and Gallic acids in the barks of some species of Eucalypts.

Systematic Name.	Vernacular Name.	Locality.	Tannic Acid.	Gallic Acid.
Eucalyptus Stuartiana.	Mountain Ash.	Gippsland.	4.6	0.7
" longifolia.	Woollybutt.	"	8.3	2.8
" corymbosa.	Bloodwood tree.	"	2.7	0.8

III. GUM-RESINS OF THE EUCALYPTS.

These are produced in greater or lesser quantities by all the species of this genus; from this circumstance the Eucalypts are almost universally called by the Colonists "Gum trees."

These substances occur within the trunks of trees of all sizes, in flattened cavities in the otherwise solid wood, which often lie parallel to the rings of growth. In such places the deposition of the gum-resin, which is at first a viscid liquid, becomes gradually inspissated, and subsequently hard and brittle. The liquid gum-resin may be obtained by making incisions in the stems of growing trees; they are very viscid treacle-like fluids, not differing in chemical composition from those which have undergone indurations, save that they contain more water; the indurated ...oses from 15 to 20, and the liquid gum-resin about 65 per cent. at a temperature of 212° F. When thus dried they are exceedingly friable and easily pulverised.

In their general characteristics, these gum-resins resemble each other very closely. In the solid form they present the appearance of small angular masses, not unfrequently intermixed with particles of wood. The prevailing color is dark red-brown, in some cases dull with olive and yellowish tints, in others bright ruby colored and transparent; black and opaque pieces are also very commonly interspersed through each of the varieties described. In the mouth they are tough, adhere to the teeth, and color the saliva red; their taste is intensely astringent, with a slight bitter flavor; in this respect, however, there is some dissimilarity.

The gum-resin from *Eucalyptus resinifera* is that which is known under the name of Botany Bay Kino; it is for all medi-

cinal purposes considered equal to Kino: that from *Eucalyptus rostrata* is preferred to others as a therapeutic, and as an astringent is particularly administered in Europe and India in cases of chronich diarrhœa. The solvent action of water upon these gum-resins differs according to the species operated on. The aqueous solutions give an acid reaction; in these solutions acetate of lead gives copious gelatinous precipitates; solution of gelatin causes precipitates, which however do not in any case appear to be so abundant as might have been anticipated from the intense astringent taste of these gum-resins. Ferric salts give precipitates of various shades of green and black; mineral acids produce bulky flocculent deposits.

These bodies, so far as I am aware, have hitherto been but very cursorily examined: they offer an interesting field for chemical investigation.

IV. Essential Oils from the Eucalypts.

To Baron Von Mueller is due the credit of having been the first to draw attention to this important subject, important, whether regarded from a scientific point of view, or one of industrial importance, as will be conceded on becoming acquainted with their valuable properties. At his suggestion, Messrs. Bosisto and Johnson entered upon the preparation of the essential oils from a number of species of the genus; in each case determining the yield, etc., etc., the material upon which their experiments were conducted having been supplied by Baron Von Mueller, all uncertainty regarding the true botanical name of the trees from which the samples were obtained has been removed. The supply of material from which these oils are prepared, is almost unlimited: the plants furnishing it constituting the great bulk of the forest vegetation of the country. Speaking of Victoria alone, the area in that colony occupied by forest trees and scrubs has been estimated at 73,000 square miles, of which 71,500 square miles are occupied by Eucalypti of various species; and wherever these trees are felled for timber (this more especially applies to *Eucalyptus globulus*, the timber of which is always in great demand), the foliage which otherwise is wasted, would be available in great abundance for the extraction of the oil.

Mr. Jas. Bosisto, with a praiseworthy spirit of enterprise,

entered upon the preparation of these oils on a large scale, with what success (commercially speaking) I am, however, not prepared to state. The similarity in the general properties of these oils is so great that it may suffice to make some general allusions to them here, referring the reader for fuller information to the short descriptive account of each of the various oils given under their respective headings further on. They are all soluble in all proportions in turpentine, both fat and drying oils, benzine, naptha, ether, chloroform, and absolute alcohol. Spirits of wine dissolves them pretty freely; and water on being agitated with an excess takes up in most instances about 1 per cent. by weight.

Inasmuch as they all possess medicinal properties, they will no doubt ultimately meet with extensive application in medicine.

As solvents for a great variety of resinous substances, they are all more or less excellent; amongst other resins dissolved by them, is, singular to say, the fossil Kaurie gum (*Dammara Australis*) of New Zealand, a resin, the exportation of which, in large quantities has hitherto been retarded in consequence of the difficulty experienced in bringing it into perfect solution. From this it will be seen that these oils are well adapted for the preparation of varnishes and lackers.

For illuminating purposes they are equally valuable. In all cases they burn with a brilliant flame, almost equal, and in some cases even superior, to that from the best American kerosene, whilst the odor, if any, produced by their combustion, is more agreeable, and, unlike it, they leave no stain upon paper or clothing. Notwithstanding that the quantity of oil obtained from each species was determined with considerable accuracy, the results cannot be regarded as absolutely constant under all circumstances; great variations will be perceptible in the producing powers of oil-bearing trees, due to differences in age (experiments proved that a much larger yield was obtained from the more perfectly matured leaf than from those of younger growth), in the localities where grown, whether in high or low, moist or dry ground, in the time of year when the leaves were gathered, and in climatic influences generally.

The apparatus, employed by me, when preparing any of the Eucalyptine oils, was the ordinary still, inside of which was placed a strong wire-net basket, about two or three inches less in diameter than the still, and having legs so as to raise it about an inch from the bottom. By this arrangement the material ope-

rated upon was prevented from coming into direct contact with the surface of the still. The leaves having been introduced into the basket, water was poured on, the still adjusted as for an ordinary distillation, and direct heat applied. The oil passes over and condenses with the aqueous vapour, and from the watery portion of the distillate is separated by mechanical means. When steam is at command the above method can, it is needless to say, be greatly improved upon.

As previously stated, the *Eucalyptus globulus* is perhaps the species best known outside Australia, from the fact of its having been introduced into Europe, etc., and has therefore been most handy for investigation. It is consequently the oil from this tree which has received most attention, and in alluding to it further on, mention will be made of the experiments of M. Cloëz, who has studied its chemical properties.

The following series of essential oils includes those from the most common and important trees of the genus. Appended is a short notice of their general behavior with re-agents. The scale employed in taking temperatures was Fahrenheit's.

1. *Eucalyptus amygdalina*, Labillardière—one of the so-called Peppermint-trees—occurs in Victoria, New South Wales, and Tasmania. In the deep recesses of some of the Victoria Ranges it is found of colossal size; in more open places it is a middle sized tree. The foliage of this Eucalypt contains a larger percentage of essential oil than any of its congeners—100 lbs. of the freshly gathered leaves, including the small branchlets to which they are attached, gave 60.50 fluid ounces.

The oil is a thin transparent fluid of a pale yellow color, having a pungent odor, much resembling that of oil of lemons, but coarser and stronger; its taste is rather mild and cooling, producing an after sensation in the mouth resembling camphor, with something of its bitterness. Its specific gravity is 0.881. It boils freely at 330°; but as the evaporation proceeds, the mercury rises rapidly to 370°, where it remains almost stationary. Cooled to 0° F., it at first becomes turbid, and then clearing, deposits a white flocculent substance, which melts at + 27° F. Suffered to evaporate spontaneously, it proves to be somewhat less volatile than oil of turpentine. Conformably with other essential oils, it leaves no stain on paper; in shallow vessels it absorbs oxygen, giving rise to a residual resinous matter. It is

soluble in all proportions in turpentine, both fat and drying oils, benzine, naptha, ether, chloroform, and absolute alcohol. Spirits of wine dissolve it pretty freely; and water, on being agitated with an excess, takes up 1 per cent. by weight.

This oil, placed in a shallow vessel, is ignited with great difficulty, by means of a burning match of wood or paper; in this way it cannot be made to take fire by contact with flame until it has become quite hot. It burns with a bright flame accompanied with much smoke. Burned in a kerosene lamp, it gives a flame almost as luminous as that from American kerosene, but somewhat yellower. It is a good solvent for a variety of resinous substances.

2. *Eucalyptus oleosa*, Ferd. Mueller. This, with the species *E. dumosa*, All. Cunningham, and *E. socialis*, Ferd. Mueller, forms the dense masses of vegetation known as Mallee scrub, which covers the greater part of the vast tracts of level country towards the north-west of Victoria. Its dimensions require it to be ranked as a shrub, inasmuch as it rarely exceeds twelve feet in height; the individuals of the species are clothed with foliage to the ground.

Its habitat extends from the Murray to the south of Lake Hindmarsh, and to Spencer and St. Vincent's Gulfs in South Australia; it also occurs in the vicinity of Lake Torrens, and in the neighborhood of the Darling and Murrumbidgee. In Victoria alone, the River Murray is for about 270 miles of its course covered on its southern bank with Mallee scrub, which recedes in some cases to a short distance inland, whilst in others it comes down to the water's edge. The foliage of this shrub is rich in essential oil; 100 lbs. of the green leaves and branchlets gave 20 fluid ounces.

The oil is a thin mobile liquid, of a pale yellow color; the taste, as compared with others from Eucalypts, is mild, the flavor is camphoraceous, and, in a slight degree, suggestive of oil of turpentine. Its odor is distinctly mint-like, and not so agreeable as that of *E. amygdalina*. Its specific gravity is 0.911: it boils freely at 322°, the temperature gradually rising to 350°, where it remains stationary. It is a good solvent for a variety of resinous bodies.

3. *Eucalyptus Leucoxylon*, Ferd. Mueller—the Ironbark-tree—is found in South Australia, Victoria, and New South Wales. In Victoria it occurs on barren ranges, and is frequent in the vicinity of gold fields; its presence is regarded by the miner as an indication of an auriferous region.

The foliage upon which the experiments were conducted, had, in their transport, suffered fermentation, and this to a certain extent must have acted disadvantageously upon the yield of oil; consequently the amount given can only be regarded as approximate. The quantity obtained from 100 lb. of the leaves was 16.88 fluid ounces. The oil is a thin, limpid, very pale yellow fluid, in taste and smell closely resembling that from *E. oleosa*. Its specific gravity is 0.923: it boils at 310°, the mercury subsequently rising to 352°. It ignites with difficulty in open vessels; in the lamp it burns well, with a dense white luminous flame. It is a good solvent for a variety of resinous bodies.

4. *Eucalyptus goniocalyx*, Ferd. Mueller—one of the White Gumtrees; in some districts it is called the Spotted Gumtree. It is found in Victoria and New South Wales. A gigantic tree. Although the leaves of this species are not so rich in essential oil as those of *E. amygdalina*, the yield is nevertheless very considerable: 100 lbs. of fresh leaves gave 16 fluid ounces.

This oil is of a very pale yellow color, possessed of a pungent penetrating odor, somewhat disagreeable: its taste is diffusible, strong, and exceedingly unpleasant. It has a specific gravity of 0.918; it boils at 306°, the mercury immediately rising to 346°. This oil is admirably adapted for illuminating purposes; it produces a brilliant white flame, superior in intensity and color to that from the best American kerosene. It is a good solvent for a variety of resinous bodies.

5. *Eucalyptus globulus*, Labillardière—Blue Gumtree—occurs in Victoria and Tasmania. In deep declivities this tree grows to colossal size; near the coast, where it is found occupying open spaces, it is usually of diminutive growth. The amount of oil obtained from 100 lbs. of freshly gathered leaves was 12.50 fluid ounces.

The oil is a thin limpid fluid of a very pale yellow tint; its odor is not unlike cajuput (to which indeed all the Eucalyptine oils have more or less resemblance); the camphor-like smell

however, predominates. Its taste is not so disagreeable as the preceding, and more cooling and mint-like. It has a specific gravity of 0.917; it boils at 300°, the mercury subsequently rising to 350°. Reduced to a temperature of 0° F., it remained perfectly clear: it ignites with difficulty in open vessels. In a lamp it gives a dense white flame, superior to kerosene, without smoke or smell. It is a good solvent for a variety of resinous bodies.

The following results were obtained by M. Cloëz in his chemical investigations in *E. globulus*:

From leaves which had been brought from Australia, and were completely dry, he obtained about 1.5 per cent. essential oil [in Table VII. 0.72 is given as the percentage obtained from fresh leaves, assuming the latter to contain 53 per cent. water (vide note to Table): calculation will give 1.53 as the percentage to be obtained from the dry material; coinciding with the results obtained by M. Cloëz.]

M. Cloëz says: This essence is a very fluid liquid, slightly coloured, and having an aromatic odor, which reminds one of camphor. Heated in a distilling apparatus, it commences to boil at about 338° F. The thermometer rises rapidly to 347° F., where it remains till about half the product has passed in distillation. Another portion of the essential oil passes between 370°.4 and 374° F. By further application of heat, a small quantity of volatile liquid is obtained at a temperature slightly over 392° F.

The liquid distilled between 338° and 352°.4 F. is not a pure product. On rectifying with potash and chloride of calcium, a very fluid colorless liquid is obtained, which boils at 347° F., and which M. Cloëz calls Eucalyptol. It is much lighter than water; its density is 0.905 at 46°.4 F., and it turns the plane of polarisation to the right. It is soluble in alcohol, but only very slightly so in water. Its composition, according to M. Cloëz, is $C_{24}\ H_{20}\ O_2$. When treated with nitric acid, one of the products of the reaction is a crystallisable acid, probably analagous to camphoric acid. Another product, obtained by distillation of Eucalyptol with phosphoric anhydride in a retort, is Eucalyptene, a hydrocarbon with the formula $C_{24}\ H_{18}$. A further product, obtained by the action of phosphoric anhydride, is called by M. Cloëz Eucalyptolene.

6. *Eucalyptus corymbosa*, Smith—the Bloodwood tree—found in Victoria, New South Wales, and Queensland—a rather large tree. Unfortunately these leaves had suffered somewhat from fermentation, and in consequence it is only possible to give the approximate yield: and this was for 100 lbs. of leaves 12.50 fluid ounces.

The oil is a colorless and limpid fluid; in odor it differs from all the other Eucalypti oils; so much so indeed that it could scarcely be recognized as of Eucalyptine origin. Its smell, compared with the others, is much fainter and milder, and whilst partaking slightly of the lemon odor of that of the *E. amygdalina*, combined with a trace of attar of rose, it wants altogether the characteristic pungency and freshness of its congeners. The taste is slightly bitter, producing the usual after-taste of peppermint, and irritating the throat; but it is not so diffusible and pungent as many others. The specific gravity is 0.881. In the lamp it burns with a flame rather more luminous than that from American kerosene, but somewhat yellow. It is a good solvent for a variety of resinous bodies.

7. *Eucalyptus obliqua*, L'Heritier—the Stringybark tree—found in Victoria, South Australia, New South Wales, and Tasmania. In Victoria alone, the area almost exclusively wooded with the stringybark tree extends over many thousand square miles. The height of the trees of greatest size ranges from 300 to 400 feet.

With regard to the yield of oil, 100 lbs. of freshly gathered leaves afford 8 fluid ounces. It is a transparent reddish-yellow fluid of a mild odor, as compared with that of *E. goniocalyx* and *E. globulus*, and much less disagreeable. In taste it resembles the other Eucalyptine oils, but is rather more irritating in the mouth, and also distinctly bitter though less unpleasant. The specific gravity of this oil is 0.899; the boiling point is 340°, the mercury afterwards rising to 382°; cooled to 0° F. it becomes turbid and opalescent. In the lamp it burns with a fine flame, not quite so white, however, as that from *E. goniocalyx* and *E. globulus*. It is a good solvent for a variety of resinous bodies.

8. *Eucalyptus fissilis*, Ferd. Mueller—the Messmate tree. This tree occurs under the same conditions as *E. obliqua*. The

yield of oil from the foliage of this species is the same as in the last case, viz. 8 fluid ounces from 100 lbs. of freshly gathered leaves. This oil has a pale reddish-yellow color, and a rather mild and agreeable odor, in which respects it resembles the oil from *E. obliqua*. Its taste likewise is very similar, like it, attacking the throat. Its specific gravity is 0.903: it boils at 350°, the temperature rising till it reaches 386°. In a lamp it burns with a flame rather less luminous than that from American kerosene, the flame is somewhat yellowish. This essential oil in common with those from other species of Eucalypts, is a good solvent for a variety of resinous bodies.

9. *Eucalyptus odorata*, Behr—one of the so-called Peppermint trees. This species occurs in South Australia, where it forms in open reaches park-like scenery.

The quantity of oil furnished by the leaves of this species is not large; two samples were prepared; the difference in yield was so great, and dissimilarity in other respects such, that it is considered desirable to give a separate description of either, distinguishing them as No. 1 and No. 2.

In the case of No. 1 the yield was only 0.69 fluid ounces from 100 lbs. of the fresh leaves; while in the case of No. 2 a similar quantity of leaves gave 4.17 fluid ounces. The discrepancy is not easily accounted for, and is possibly due to accidental circumstances. Both samples of oil had a pale, yellowish color, inclining slightly to green; they are limpid fluids, diffusing an aromatic smell, in which one resembling that of camphor predominates. The taste is similar to that of *E. obliqua*, but milder. Oil No. 1 had a specific gravity of 0.899; its boiling point was 335°, the temperature subsequently rising to 390°: in a lamp it did not give quite such a brilliant or white flame as that from good kerosene. Oil No. 2 had a specific gravity of 0.922; its boiling point was 315°, and as evaporation proceeded, the temperature rose to 356°. In a kerosene lamp it burnt exceedingly well, affording a very brilliant white light. A good solvent for a variety of resinous bodies.

10. *Eucalyptus longifolia*, Link—the Woollybutt. This Eucalypt is met with in Victoria and New South Wales: is occurs as a tall stately tree. The yield of oil from 100 lbs. of freshly gathered leaves is 3.40 fluid ounces: the specific gravity

is 0.940: its boiling point is 380° the mercury ultimately rising to 420°: the taste is aromatic, and cooling, with but little pungency, it has a fragrant camphoraceous odor, and an oily consistency. In a lamp it gives a good bright clear flame, but somewhat inferior to kerosene in intensity. It is a good solvent for a variety of resinous bodies.

11. *Eucalyptus rostrata*, Schlechtendal—The Red Gumtree (but not of West Australia)—This variety has a wider range than any other of the Australian timber trees, being found in West Australia, South Australia, Victoria, New South Wales, Queensland, North and Central Australia.

Compared with the afore mentioned, the yield of oil from this species is small, 100 lbs of fresh leaves furnishing 1.56 fluid ounce. It has a similar taste and smell to that from *E. odorata*: color pale yellow with occasionally a reddish amber tint: specific gravity 0.918: the boiling point is lower than that of any of the others, being 280°, the mercury afterwards becoming stationary at 358°. Evaporated to about one-fourth its bulk, it almost geletinises when reduced to zero, retaining its transparency. In the lamp this oil burns well. It is a good solvent for a variety of resinous bodies.

12. *Eucalyptus viminalis:* Labillardière—The Manna Eucalypt—found in South Australia, Victoria, New South Wales and Tasmania—a middle sized tree.

The yield of oil from this species is small, the amount from 100 lbs of fresh leaves being 0.65 fluid ounces. The color of this oil is pale yellowish-green: the odor disagreeable, but not very strong or penetrating: its taste is similar to that of *E. odorata*. It has a speific gravity of 0.921: it boils at 318° the mercury subsequently rising to 360°. It burns well in a lamp and is a good solvent for a variety of resinous bodies.

13. *Eucalyptus citriodora*, Hooker—the Citron-scented Gum—a tree found in the North of New South Wales and the South of Queensland. It yields a fair amount of oil, which forms a superb cosmetic.

General behaviour of the Essential Oils of Eucalyptine Origin with Reagents.

Sulphuric acid, in the cold, causes a gradual darkening in color: the tint varying somewhat according to the oil operated upon, but the final result is in all cases a deep brown. When heat is employed these changes are rapidly brought about: the acid is decomposed with evolution of sulphurous acid, the oil being converted into a charred mass, a part of which is soluble in water, affording a liquid so dark as to be almost black.

Nitric acid in the cold acts but slowly: when concentrated it produces numerous shades of brown, olive, purple, violet and grey: when heated the action is very violent: Nitrous acid fumes are given off in great abundance, the oil is converted into a brown resinous body possessed of a pungent odor, hard and brittle yet becoming plastic-like pitch soluble in alcohol, and ether: fusing at a moderate heat and inflammable and possessed of marked acid properties, as it forms colored salts with the bases, and the alcoholic solution reddens litmus.

Hydrochloric acid, does not give rise to any very marked results: but the action of this reagent on these oils has not as yet been sufficiently studied.

Iodine: when brought into contact with these oils causes no explosion, even when the temperature is raised: but a dark colored solution is created, which, when heated, emits peculiar variegated vapors, in which the colors yellow, red, violet, green and blue are very beautifully visible, particularly in bright sun light.

Sodium: a piece of this metal introduced into one of these oils, causes an instant evolution of gas upon its surface, the action is aided by heat: it is not under any circumstances so energetic as that caused by the same treatment of some other essential oils, such as oil of cloves. The soda formed is taken up by the oil giving rise to a dark brown liquid from which water extracts the color, and acquires alkaline properties. Caustic potassa aided by heat, and an alcoholic solution of potash produce a very similar result so far as color is concerned.

Table VII.

Showing the percentage of Essential Oil obtained from the foliage of certain Eucalypts; likewise the boiling point and relative illuminating power of said Oils.

Species of Tree from the foliage of which the Oil was prepared.		Yield from freshly gathered material. per cent.	Specific gravity at 60° F.	Boiling point. (Fahrenheit.)		Relative illuminating power. Kerosene = 1.000.
Systematic Name.	Vernacular Name			Lower.	Higher.	
Eucalyptus amygdalina	Peppermint tree	3.33	0.881	330°	370°	0.849
" oleosa	Mallee scrub	1.14	0.911	322°	350°	1.080
" Leucoxylon	Ironbark tree	0.97	0.923	310°	352°	1.090
" goniocalyx	White Gumtree	0.92	0.918	306°	346°	1.098
" globulus	Blue Gumtree	0.72	0.917	300°	350°	1.048
" corymbosa	Bloodwood tree	0.69	0.881	—	—	1.004
" obliqua	Stringybark tree	0.45	0.899	340°	382°	0.870
" fissilis	Messmate tree	0.45	0.903	350°	386°	0.908
" odorata [1]	Peppermint tree	0.04	0.889	335°	390°	0.850
" " [2]	" "	0.24	0.922	315°	356°	1.158
" longifolia	Woollybutt	0.20	0.940	380°	420°	0.967
" rostrata	Red Gumtree	0.09	0.918	280°	358°	0.942
" viminalis	Manna Eucalypt	0.04	0.921	318°	360°	1.082

Note.—Referring to Table I, and calculating from the percentage of water found in the leaves of the five species of Eucalypts therein alluded to, it will be found that the average amount in round numbers is 53 per cent. This will enable a comparison to be made between the productiveness of these trees, and plants from other countries which are frequently dried before distillation.

Table VIII.

Showing the solubility of certain resinous substances in Eucalyptine Oils.

Name of Resinous Substance.	Number of ounces (Avoirdupois) soluble in 1 imperial pint of :—		
	Eucalyptus amygdalina.	Eucalyptus globulus.	Eucalyptus obliqua.
Camphor	23.3	14.5	21.8
Rosin	20.3	....	....
Mastic	17.5	12.7	16.4
Elemi	10.2	....	....
Sandarac	7.3	7.3	10.9
Kaurie Gum (New Zealand)	7.3	8.0	10.2
Dammara	7.3	....	....
Asphalt	5.8	6.5	....
Dragon's blood	4.3	....	....
Benzoin	2.8	....	....
Copal	1.33	1.02	0.76
Amber	1.74	....	....
Anime	1.45	0.81	1.09
Shell-lac	1.16	0.13	0.98
Caoutchouc	0.73	....	....
Beeswax	0.73	....	....

Note.—Only three of the Essential Oils have here been enumerated, these being deemed sufficient to give a general idea of the solvent power of these bodies. Blanks indicate that no experiment was instituted. The experiments were conducted at the ordinary temperature.

V. Manna.

There are two varieties of a substance called Manna. The one is secreted by the leaves and slender twigs of the *E. Viminalis* (Manna Eucalypt) from punctures or injuries done to these parts of the tree. It occurs most commonly in the form of irregular little rounded masses of an opaque white color, possessing a pleasant sweetish taste. These little masses often present an aperture at one end, shewing the attachment of the small twig from which the Manna has been secreted in a liquid form, at first transparent and of the consistence of thin honey, and then becoming solid, drops off in the condition that has been mentioned.

This Manna has been examined by Johnston, who found it to contain a crystallisable sugar (Melitose,) containing according

to his analysis $C_{12}\ H_{22}\ O_{11}$, $H_2\ O$, and identical in composition with grape sugar: Berthelot by whom it was more fully investigated also pronounced it to be identical with grape sugar and very similar in its reactions: he regards it as a compound of grape sugar with the isomeric substance eucalyn. Melitose is extracted from the Manna by water, it crystallises in slender needles, possessing a slightly saccharine taste. The other variety of Manna is found upon the leaves of the *E. dumosa* (or Mallee scrub) whose foliage is occasionally so whitened over with the profusion of this substance as to present the appearance of being covered with frost: it is the secretion of the pupa of an insect of the Psylla family; and is called Lerp by the aborigines of the Northern parts of the colony. It occurs in masses of aggregated cones, covered with a filamentous material like wool, the color varies from an opaque white to a dull yellow. These varieties of Manna are of no medicinal value.

Mr. S. J. LYMAN in moving a vote of thanks to Mr. Hoffmann for the interesting and valuable paper with which he had favored the College, said he expressed the sentiments of all present when he stated that it had seldom been their lot to listen to a lecture containing information of such interest. The information regarding the Eucalypts is what he had not been able to find in books. His attention was first called to these remarkable trees by having observed one for the first time in the conservatory of a friend in New Jersey, and he now held in his hand some of the leaves plucked from the tree. On holding this leaf up to the light you will at once perceive the essential oil vessels with which it is filled, very similar to those of the Orange and Lemon peel. One of these leaves contains more essential oil than a whole plant of Wintergreen, Lavender or Mint. When we consider the vast height of the Eucalypts, the wide spreading branches with myriads of leaves, capable of sheltering a small army, the question may occur, what purpose in the economy of nature does this great store of odorous oil serve. If, as Tyndal has proved, that the useful office of the odors of plants and trees is to absorb the radient heat from the earth and thus preserve uniformity of temperature by which vegetation is preserved; we can scarcely conceive the influence these forests of colossal trees have upon the climate of Aus-

tralia. It may interest the audience to know that, although we cannot boast of trees of the magnitude possessed by our fellow-colonists at the Antipodes we have trees of very respectable size in Canada A few miles in rear of L'Assomption, on Hall & Co's timber limits, stands a pine of nearly 200 feet in height and of 21 feet in circumferance. The branches commence at the height of 72 feet. The essential oil which Mr. Hoffmann has brought with him from Australia is very interesting, it seems allied to the Mints and fire weed and would serve the purposes of New York adulterators of essential oils in mixing, and I have no doubt a consignment of them would be quickly bought by these parties who have so reduced adulteration of oils to a science as "to deceive the very elect" in knowledge of oils, I mean the London broker in essential oils. I have no doubt this oil may prove a valuable addition to stimulating remedies for external application. Again thanking Mr. Hoffmann for giving the result of his experience in Australia, he moved the vote of thanks.

Mr. JOHN KERRY seconded the motion, and expressed his thanks for, and appreciation of, the valuable paper to which they had listened on this, to him, hitherto unknown tree, and the interesting information regarding the products of our Sister Colony. He expressed a hope that other gentleman would follow Mr. Hoffmann's example in presenting to us papers which would redound not less to the credit of themselve than the College.

The motion was carried unanimously.

The Chairman expressed the gratification Mr. Hoffmann had afforded them by his paper, and the assembly adjourned.

APPENDIX.

NOTES

ON THE

ESSENTIAL OILS

FROM

Certain Species of the Genus Melaleuca, and other indigenous Victorian Plants.

The essential oils to which allusion will now be made, were all prepared by Messrs. J. Bossisto and W. Johnson, at the suggestion of Baron Von Mueller, who also furnished the material from which they were prepared.

I.—Essential oils from certain species of the Genus Melaleuca.

These oils in common with those of Eucalyptine origin, are all possessed of medicinal properties. It is more than probable that they will all be found to act as diffusible stimulants, anti-spasmodics, and sudorifics, greatly resembling the oil of cajupt of commerce (obtained from Melaleuca leucadendron) to which they are so closely related botanically.

With regard to the yield of these plants; it will be observed that they far exceed in productiveness M. leucadendron, and the difference would be yet more striking could the leaves be operated on alone: owing to the minuteness of the same however, it is necessary to introduce the smaller branches with them into the still, so that the leaves do not constitute more than a fourth of the weight of the material employed.

In illuminating power they compare most favorably with the best American kerosene, in most cases excelling it. They are good solvents for resins, especially the oil of M. ericifolia which is not inferior in this respect to those of Eucalyptine origin: this oil ought perhaps to be regarded as the most important of this division inasmuch as the species yielding it, exists in much greater profusion and covers larger tracts of country than all the others taken together.

Melaleuca linarifolia, Smith—one of the Tea-trees, occurs in East Gipps Land, New South Wales and Queensland.

Yield: 100 lbs. fresh branchlets and leaves, gave 28 fluid ounces. The oil is a light straw-colored mobile fluid: odor resembling that of cajuput, but less aromatic and pungent: taste singularly agreeable, strongly suggestive of both mace and nutmeg, followed by the usual mint-like after taste, common in a greater or less degree to the myrtaceous oils. Specific gravity 0.903: boiling point 348° the mercury ceasing to rise at 369°: relative illuminating power 0.982, kerosene = 1.000.

Melaleuca curvifolia—one of the Tea trees. Found on the coast of Victoria.

Yield: 100 lbs. fresh branchlets and leaves gave 5.90 fluid ounces. The taste of this oil is not disagreeable; it closely resembles that of cajuput: it has an amber color and an oily consistency. Specific gravity 0.938; boiling point 364°, the mercury subsequently rising to 408°: relative illuminating power 1.031, kerosene = 1.000. A good solvent for resins.

Melaleuca ericifolia, Smith—the common Tea tree of the Colonists. Found in South Australia, Victoria, New South Wales and Tasmania.

Yield: 100 lbs. of fresh branchlets and leaves, gave 5.00 fluid ounces; a thin oil but not so mobile as the others: it strongly resembles the oil of cajuput of commerce. Color, pale yellow; smell similar to cajuput, but somewhat less agreeable: taste bitter and camphoraceous, followed by a cool sensation, like that produced by peppermint, but the similarity to camphor is less perceptible both in smell and taste than it is to cajuput. Specific gravity 0.902; boiling point 300°, the mercury rising to 362°; relative illuminating power 1.017, kerosene = 1.000. An excellent solvent for a variety of resinous substances.

Melaleuca Wilsonii,—one of the Tea-trees. Found in Victoria.

Yield: 100 lbs. of fresh branchlets and leaves, gave 4 fluid ounces. This oil has a pale yellow color and a very diffusible and pungent taste: specific gravity 0.925: relative illuminating power 1.094, kerosene = 1.000.

Melaleuca uncinata—one of the Tea trees. This plant ranges from Victoria across the Continent to Western Australia.

Yield: 100 lbs. fresh branchlets and leaves gave 1.75 fluid ounces: color of the oil green, in this respect exactly similar to cajuput; in taste it resembles more the Eucalypti: smell similar to that of cajuput, with an addition of peppermint. Specific gravity 0.920 = relative illuminating power 1.075, kerosene = 1.000.

Melaleuca genistifolia, Smith—one of the Tea-trees. This shrub is rare in Victoria, but is found in New South Wales, Queensland and North Australia.

Yield: 100 lbs. of fresh branchlets and leaves gave 1.25 fluid ounces. Color of the oil pale greenish yellow, odor and taste mild, but both characteristic of the Tea-tree oils.

Melaleuca squarrosa, Smith—one of the Tea trees. Found in South Australia, Victoria, New South Wales and Tasmania.

Yield: 100 lbs. dried branchlets and leaves gave 0.63 fluid ounces. Color of the oil green. It resembles that of M. uncinata and M. ericifolia, but its taste is disagreeable; retaining in this respect the character peculiar to the Tea-tree oils, its flavor is somewhat vapid.

II.—Essential oils from certain indigenous Victorian Plants.

These oils with one exception, are likewise all possessed of medical properties: the exception being Pittosporum undulatum; and this from its exceedingly agreeable odor, is likely to meet with application in perfumery. It is a highly ornamental bush, easily raised from seed and blooms with great profusion, and would flourish in climates similar to that of the South of France. The oils of Zieria lanceolata and Eriostemon squameus, both very closely resemble oil of rue: it is thought that these plants might be used medicinally as substitutes for the South African bucco. The oils of Mentha Australis, M. grandiflora and M. gracilis, as carminative stimulants will possibly be found equal to that prepared from M. piperita.

Atherosperma moschatum, Labillardière—Monimiaceæ. The native Sassafras tree. Found in Tasmania, Victoria and New South Wales. A middle-sized tree.

The oil is prepared from the bark: (the leaves also yield an essential oil but no examination has yet been made of the same) 100 lbs. of which dried gave 18.75 fluid ounces: it has a thin unctuous consistence: specific gravity 1.040: boiling point 446° the mercury rising to 473°. Color pale yellow deepening to yellowish-brown by age: smell oppressive and disagreeable, similar to that of the oil of Sassafras of commerce, with an admixture of oil of carraways: taste aromatic, and rather agreeably bitter, producing a local prickling sensation upon the tongue. Physiological effects, in small doses, these are described as dia-

phoretic, diuretic, and sedative, and it appears to exert a lowering influence upon the heart's action. In large quantities it must be regarded as a dangerous poison.

A decoction of the bark possesses valuable therapeutic properties, as a diuretic, and diaphoretic, effects scarcely to be ascribed to the volatile oil, inasmuch as nearly, if not the whole of this is expelled by boiling. Baron Von Mueller concluded that the bark contained in all probability an alkaloid, and investigation proved that these anticipations were well founded. To this alkaloid M. N. J. Zeyer gave the name of "Atherospermine."

Prostanthera lasianthos, Labillardière—(one of the few species of Labiatæ, which attain to large arborescent growth). Found in Tasmania, Victoria and New South Wales.

Yield: 100 lbs. of fresh leaves gave 2.60 fluid ounces. The oil is a limpid, greenish-yellow fluid: odor, mint-like: taste rather mild mint-like: after taste not disagreeable. Specific gravity 0.912.

Prostanthera rotundifolia—Yield, 100 lbs. of the fresh herb gave 12.00 fluid ounces. This oil in smell and taste, resembles the last: in color it is somewhat darker. Specific gravity 0.941.

Mentha Australis. This plant and the two following are true Mints. They are all available in very considerable quantity in Victoria and are also found in New South Wales, South Australia and Tasmania.

Yield: 100 lbs. of the fresh herb gave from 1.10 to 3.00 fluid ounces. This oil both in taste and smell scarcely differs from ordinary oil of peppermint, it is however somewhat coarser than the best samples of that article.

Mentha grandiflora—Yield, 100 lbs. of the fresh herb gave 5.00 fluid ounces. This oil has a fiery, bitter and unpleasant nauseous taste, together with the characteristic after taste: and, except for medicinal purposes, could not be used as a substitute for common peppermint. Specific gravity 0.924.

Mentha gracilis—Yield, 100 lbs. of the fresh herb gave 3.00 fluid ounces. This oil in its properties more closely resembles the M. Australis than the M. grandiflora. Its odor is like that

of oil of peppermint, with a slight admixture of pennyroyal. Its taste is diffusible, but less pungent than the oil of commerce. Specific gravity 0.914.

Zieria lanceolata—Found in Victoria, New South Wales and Tasmania.

Yield: 100 lbs. of fresh leaves and branchlets gave 6.5 fluid ounces of a pale yellow limpid oil, having an odor scarcely distinguishable from oil of rue, perhaps a little less intense and penetrating: taste, very disagreeable and acrid, strongly resembling that of rue. The physiological effects of this oil is that of a diuretic and diaphoretic. Specific gravity 0.950.

Eriostemon squameus—Yield, 100 lbs. fresh leaves and branchlets gave 4.0 fluid ounces. This oil strongly resembles the preceding, it is however less disagreeable, being more aromatic both in taste and smell, and is these respects also preferable to oil of rue.

Pittosporum undulatum—Found in Victoria and New South Wales.

Yield: 100 lbs. freshly gathered blossoms gave 2.1 fluid ounces of the oil: it is a limpid colorless fluid, of an exceedingly agreeable odor, resembling the perfume of jasmine flowers: taste, disagreeably hot and bitter with a slight trace of the flavor of oils of turpentine and rue.